Apache

SMART Briefing

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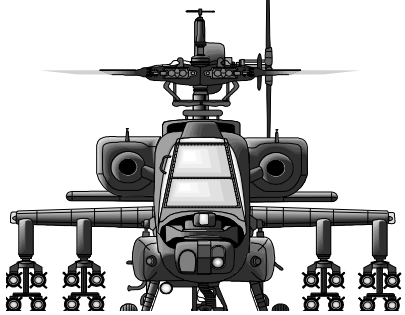
Briefing Agenda

- Purpose of the Apache SMART Briefing
- Briefing Topics
  - System Overview
  - P3I Candidates
- M&S Efforts in General Electric, Lockheed, and Boeing
- Possible Approaches to SMART/SBA
- Observations & Recommendations

The AH-64D System

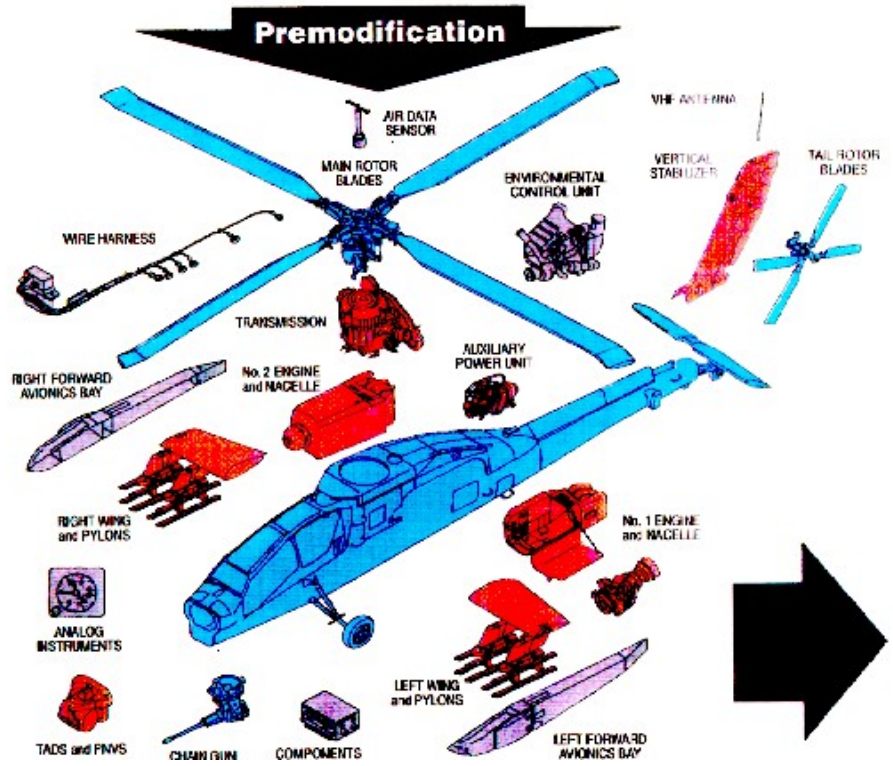


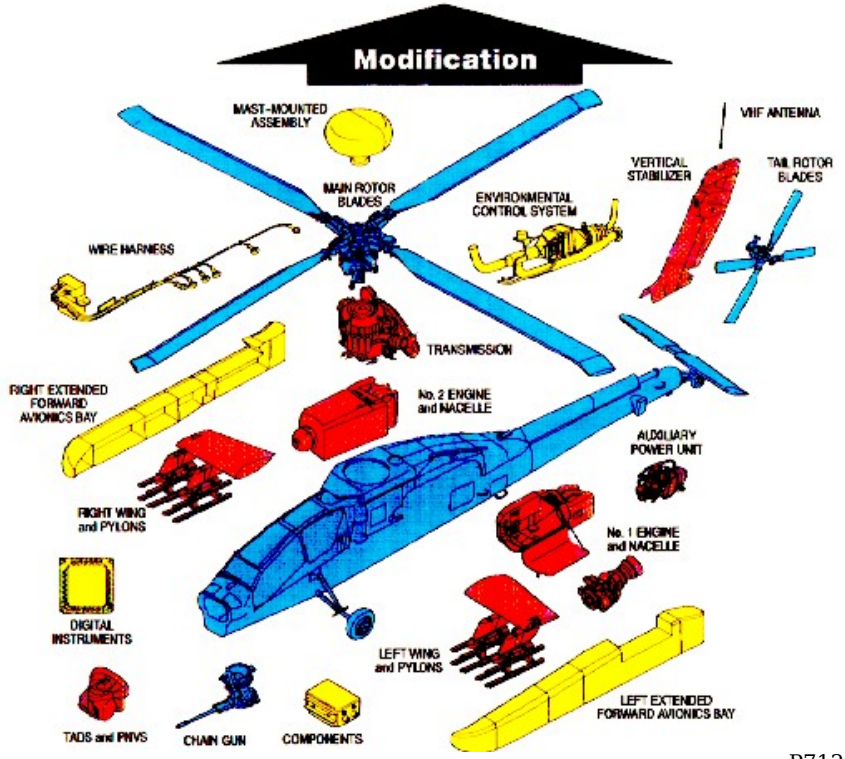
Use As-is

Modified

Excess

New





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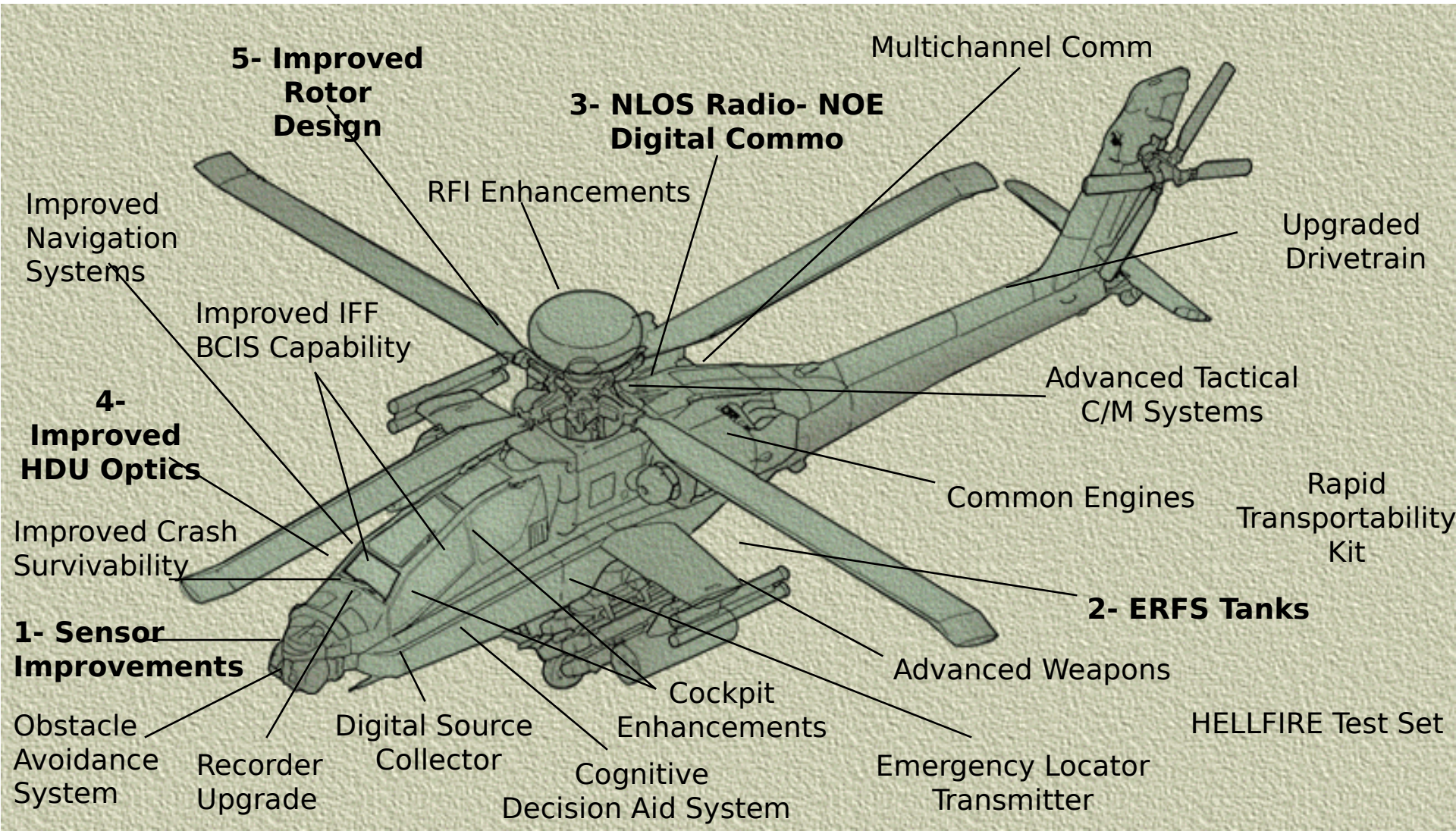
Sources of Improvements & Modifications

- Operational Capabilities Improvements & Priority List
- P3I List
- Funded Modifications
- Top Ten Cost Drivers
- Digitization
- Unfunded Requirements Li
- Diminishing Mfg. Sources

Operational Capabilities Improvement Priority List



Operational Capabilities Improvement List

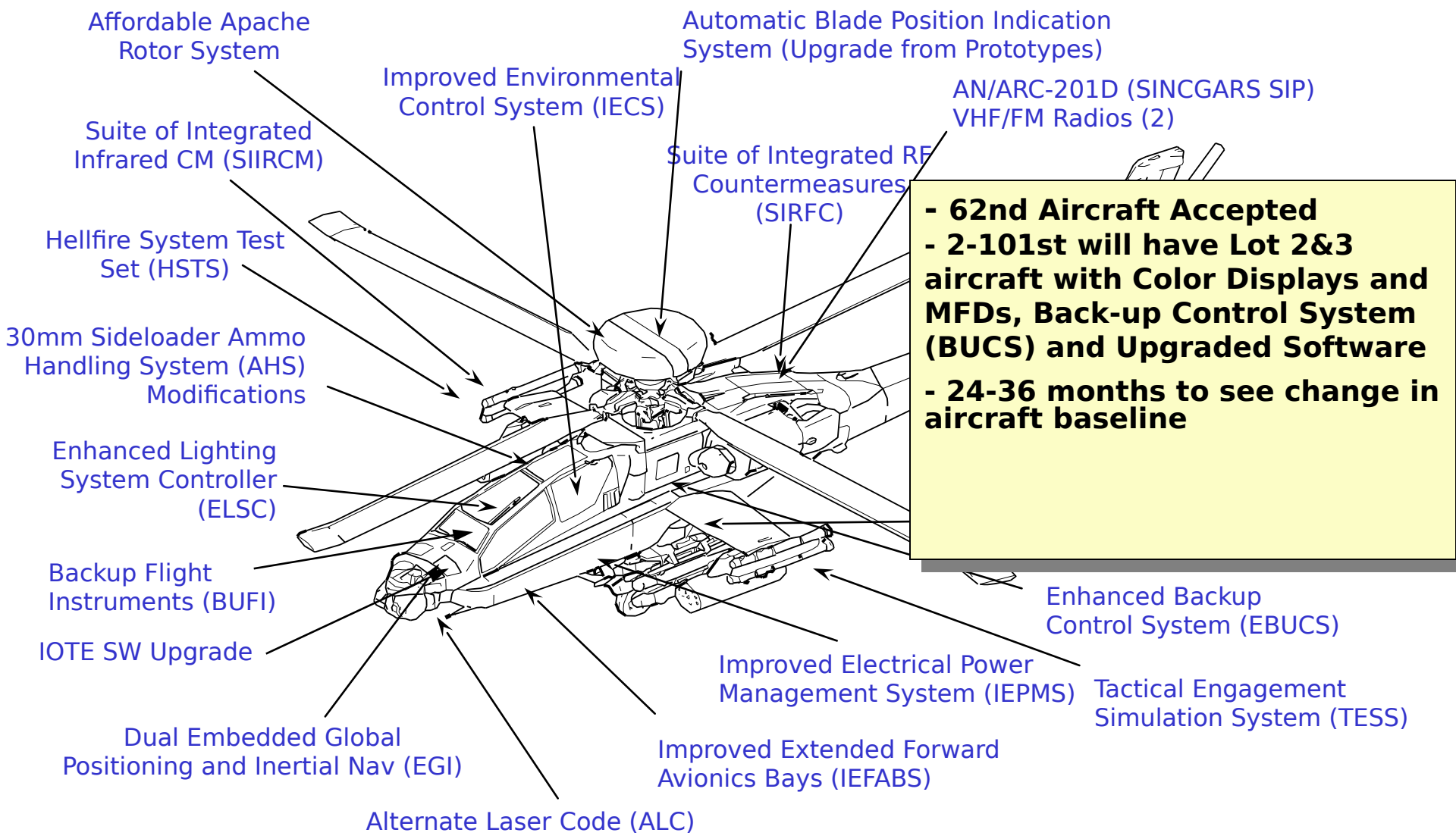
Fire Control Radar

- Algorithm Robustness Improvements
- Capability to Track Targets
- Air to Air Targeting
- Terrain Profile and Ground Map
- Unmasked Indicator

AH-64D Aircraft

- Sensor Improvements
- Extended Range Tanks
- NLOS Radio/Comm
- Improved HDU Optics
- Improved Rotor Design
- Upgraded Drivetrain
- Digital Map

Funded Modifications


Affordable Apache Rotor System
Improved Environmental Control System (IECS)
Automatic Blade Position Indication System (Upgrade from Prototypes)
AN/ARC-201D (SINCGARS SIP) VHF/FM Radios (2)
Suite of Integrated Infrared CM (SIIRCM)
Suite of Integrated RF Countermeasures (SIRFC)
Hellfire System Test Set (HSTS)
30mm Sideloader Ammo Handling System (AHS) Modifications
Enhanced Lighting System Controller (ELSC)
Backup Flight Instruments (BUFI)
IOTE SW Upgrade
Enhanced Backup Control System (EBUCS)
Improved Electrical Power Management System (IEPMS)
Tactical Engagement Simulation System (TESS)
Dual Embedded Global Positioning and Inertial Nav (EGI)
Improved Extended Forward Avionics Bays (IEFABS)
Alternate Laser Code (ALC)

- 62nd Aircraft Accepted

- 2-101st will have Lot 2&3 aircraft with Color Displays and MFDs, Back-up Control System (BUCS) and Upgraded Software

- 24-36 months to see change in aircraft baseline

Top Ten Cost Drivers

AH-64D UNIQUE (AIRFRAME)				
	NOMENCLATURE	NSN	UNIT COST	TOTAL COST
1	System Processor	5821-01-441-3667	$197,488.00	$1,974,880.00
2	Weapons Processor	1280-01-438-7346	$195,073.00	$780,292.00
3	Elec. Load Center #1	6110-01-425-7229	$151,070.00	$604,280.00
4	Display Unit	7025-01-413-1079	$183,641.00	$550,923.00
5	High Pwr Switch Module	6110-01-425-7230	$101,389.00	$304,167.00
6	Elec. Load Center #2	6110-01-425-7228	$152,956.00	$152,956.00
7	APU	2835-01-413-1057	$147,024.00	$147,024.00
8	Brake, Electric	6610-01-425-7237	$57,119.00	$114,238.00
9	Comm. Interface Unit (CIU)	5895-01-413-1054	$108,056.00	$108,056.00
10	Flight Management Computer	5826-01-440-5709	$93,077.00	$93,077.00

AH-64D UNIQUE (FCR)				
	NOMENCLATURE	NSN	UNIT COST	TOTAL COST
1	Mast Mtd Assembly(MMA)	1260-01-413-3826	$1,706,155.00	$6,824,620.00
2	Low Power RF	5998-01-397-6050	$1,068,513.00	$4,274,052.00
3	Transmitter Cont. Grp	5895-01-413-1061	$694,086.00	$3,470,430.00
4	Prgm. Signal Processor	5895-01-412-9325	$668,391.00	$1,336,782.00
5	Correlator Assembly	5895-01-413-1056	$173,752.00	$1,042,512.00
6	MMAPS Controller	6130-01-412-9323	$108,922.00	$544,610.00
7	Antenna RFI	5841-01-413-7784	$266,455.00	$532,910.00
8	Control Receiver, RFI	5895-01-413-7782	$235,322.00	$470,644.00
9	Receiver Assembly	5895-01-412-9320	$155,462.00	$310,934.00
10	Video/Post Proc. ECA	5998-01-413-7761	$25,487.00	$305,844.00

Unfunded Requirements List

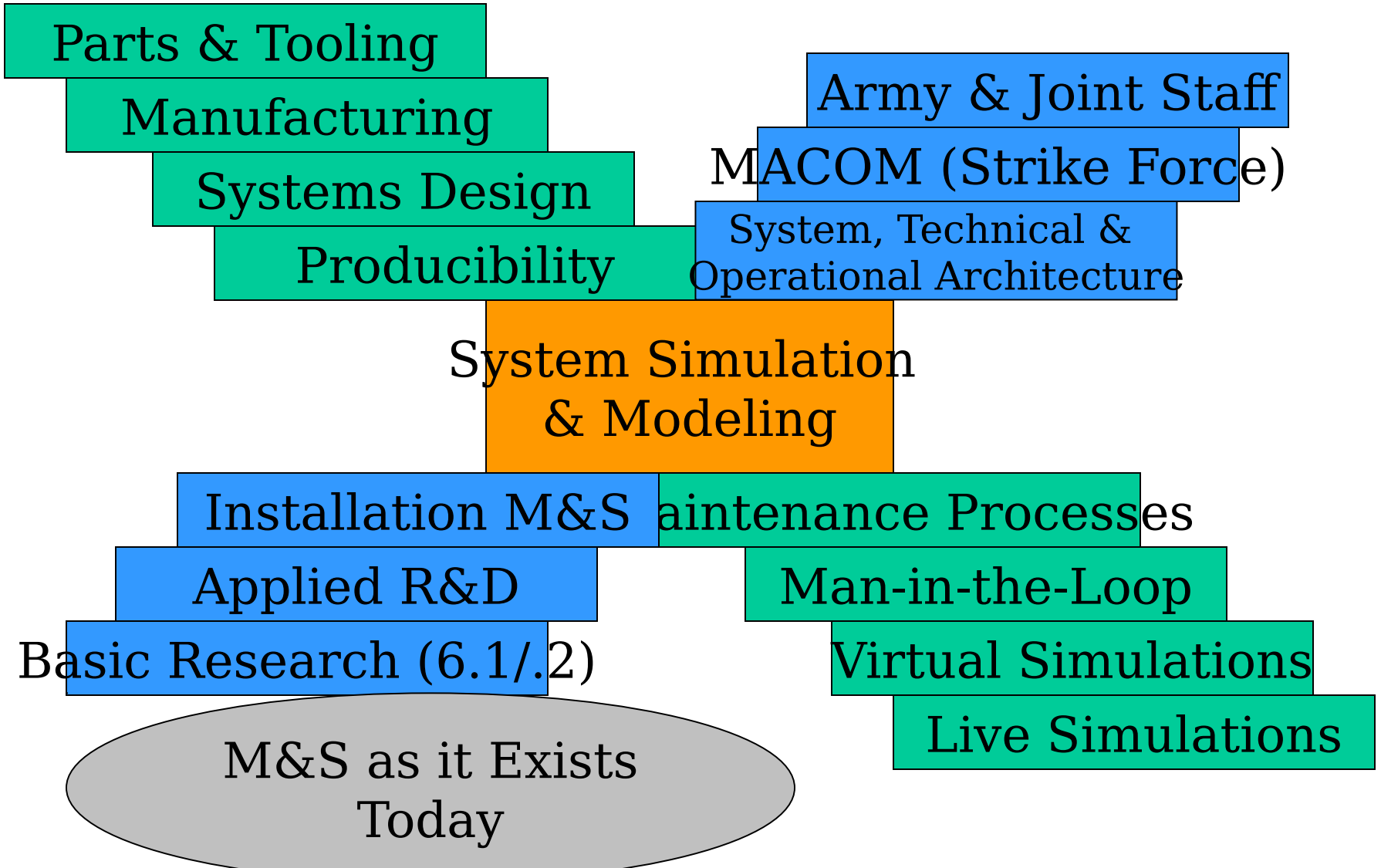
AH-64D Processor Obsolescence	45,000	Funds the procurement, integration, and test of the Systems, Weapons, and Display processors for the AH-64D aircraft being procured under the second multi-year contract.
FBCB2 (Force XXI Battle Cmd Brigade & Below) IOTE	3,000	To support testing and maintenance and technical support for this execise. Participation was mandated by DCSOPS and SARD. Helps reduce the overall NRE bill for expected MY II enhancements (e.g., Non-Line-of-sight comms, video trans, etc.) by reaping ben
Extended Range Fuel System	87,000	Procures crashworthy internal fuel tank for tactical deep operations and maintains 30MM and HF effectiveness; enables extended range operations with full missile payload. This is a CG, USAAVNC top priority.
Rotor System Upgrade	386,500	Upgrades critical components to reclaim AH-64A level performance and provide O&S cost avoidance. Continuation of COSSI initiated Apache affordable rotor program, formerly known as DUAP.
Drive System Improvement/ Drivetrain 2000	277,500	Upgrades critical components to reclaim AH-64A level performance and provide O&S cost avoidance; ORD P3I requirement. Modifies critical fuselage and wing components so acft can operate without restrictions to the flight envelope and avoid excessive fatig
Enhanced Target Classification	8,345	Procures an improved classifier (Pcc), high value target signal collection, and an embedded target classification algorithm. Will allow the FCR to train itself to recognize scanned targets, and detect and identify deep strike targets. Improvements to cl
Optical Relay Tube	15,700	Would fund Optical Relay Tube (ORT) removal in FY 99 and in FY00 (MY I) to: lower O&S costs (high failures/obsolete components), reduce injury in crash situation, reduce weight (40 lbs), and provide new display. This would complete MY I fleet of 232 A/C
FCR Extended/ Detection Range	2,782	Procures detection and classification of targets at ranges 50% greater than current capability allows. Will increase maximum standoff distance from the threat weapon system and increase the survivability of the aircraft. Support sensor fusion and precis
FCR Enhanced Aid to Pilotage	15,299	Procures terrain profiler/target overlay, terrain following/ground map, and an unmasked indicator. Merges terrain and target modes for display, creates a terrain following map to fly NOE, and cues crew when FCR is unmasked.
Air-To-Air Launcher [Stinger/Starstreak]	52,200	Procures Air-To-Air Launchers LB a/c; 600 launchers [2 per a/c, 32 spares) @ $87K ea. AH-64D battalions are unable to counter air threats effectively without these. (NOTE: A-Kits are funded -- i.e., ejector, rack assembly, fairings & software.)
FCR Detection Enhancements	6,954	Provides enhanced processing capabilities, algorithm robustness improvements, and improved performance in variable clutter.
Multi-Mode Laser	47,600	Provides eye-safe laser capability for training [eye-safe and tactical laser; Laser UFRs under management of HTI -- this is a MEMO entry for HTI BOSS only.]
Aircraft Survivability Equipment (ASE) Modification/ Refurbishment	2,493	Modification and/or refurbishment to select ASE items, including ALQ-144; APR-39; ALQ-136; and M-130 *READINESS UFR*
Main Rotor Blade Repairs	9,600	Repair of rotor blades at CCAD *READINESS UFR*
Integrated Derotating Unit (IDU)	9,250	Procures IDUs to accommodate the addition of 26 FCRs funded in FY 03. Also, 15 ea in FY 04 &05, and 145 in the EPP (FY 06-09) --i.e., for 175 unfunded FCRs, FY 04-09. Cost is $46K each. *READINESS UFR*

Apache SMART Goals

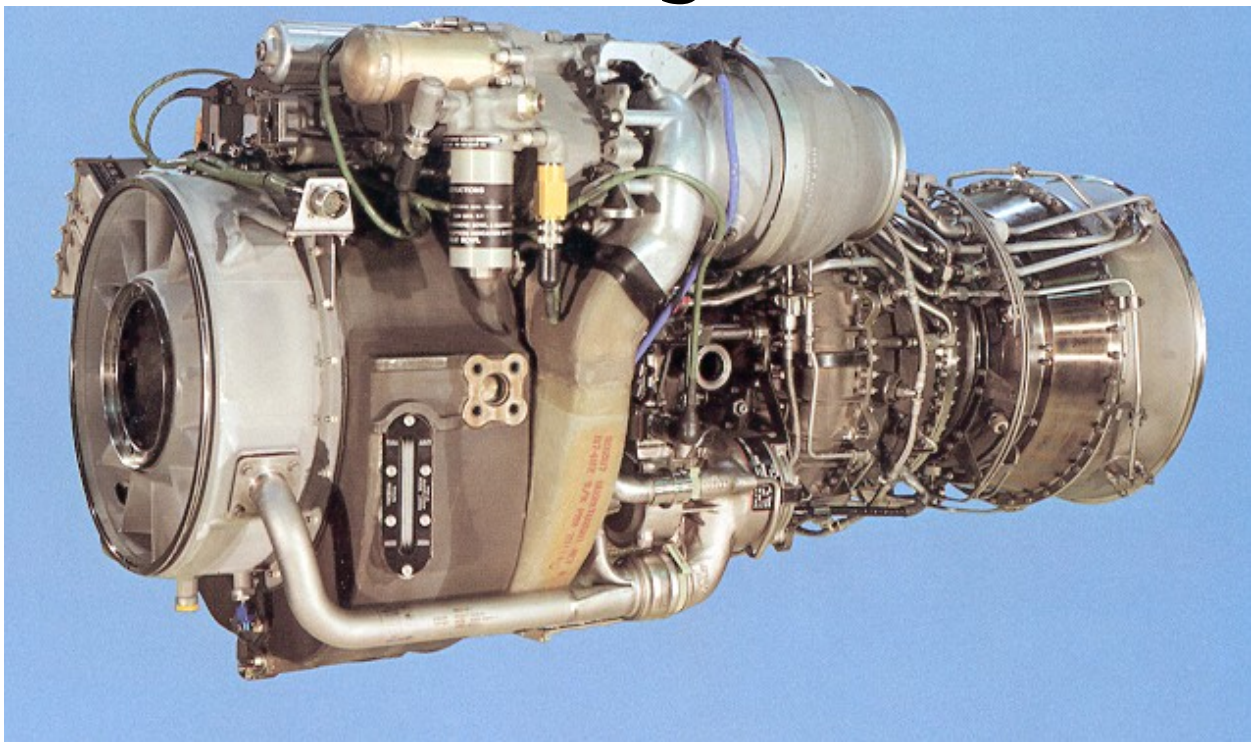
- 50% Reduction in Cycle Time
- 30% Reduction in Total Cost of Ownership
- Maximize use of Industry's Investment
- Integrate with Requirements Analysis & Funding
- Execute through Performance

"Better, Faster, Cheaper" has taken hold of the acquisition community. But I assure you that this is not simply a slogan. It is a fundamental blueprint for survival…
Dr. J. Gansler

Modeling and Simulation Efforts



General Electric's Sprinta Engine



Video Clips

Modeling and Simulation Efforts

Parts & Tooling

Manufacturing

Systems Design

Producibility

Army & Joint Staff

MACOM (Strike Force)

System, Technical & Operational Architecture

System Simulation & Modeling

Installation M&S

aintenance Processes

Applied R&D

Man-in-the-Loop

Basic Research (6.1/.2)

Virtual Simulations

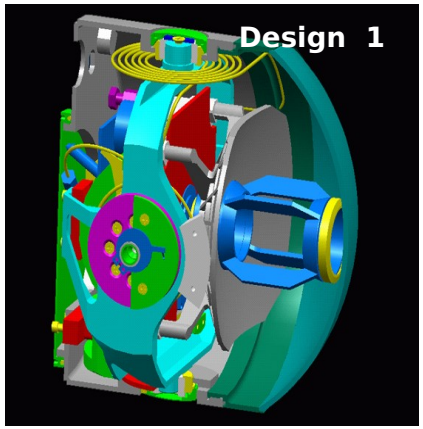
Live Simulations

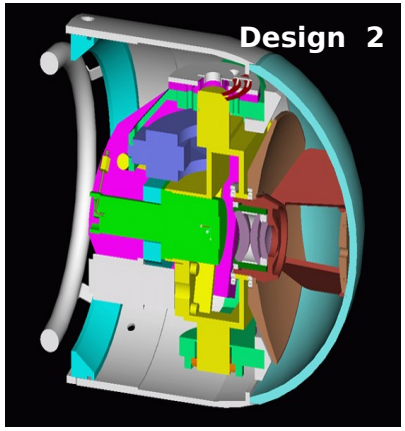
How can it be more efficient?

Lockheed Martin Electronics & Missile Systems

Development of an Adaptive Modeling Language (AML) for Knowledge-Based Engineering with Application

	Optics	Mechanical	FE Analysis	Servo	Total
Design 1	1,082[1] hrs	4,955 hrs	1,214 hrs	1,383 hrs	8,634 hrs
Design 2		2,356 hrs	3,384 hrs	0 hrs	7,026 hrs

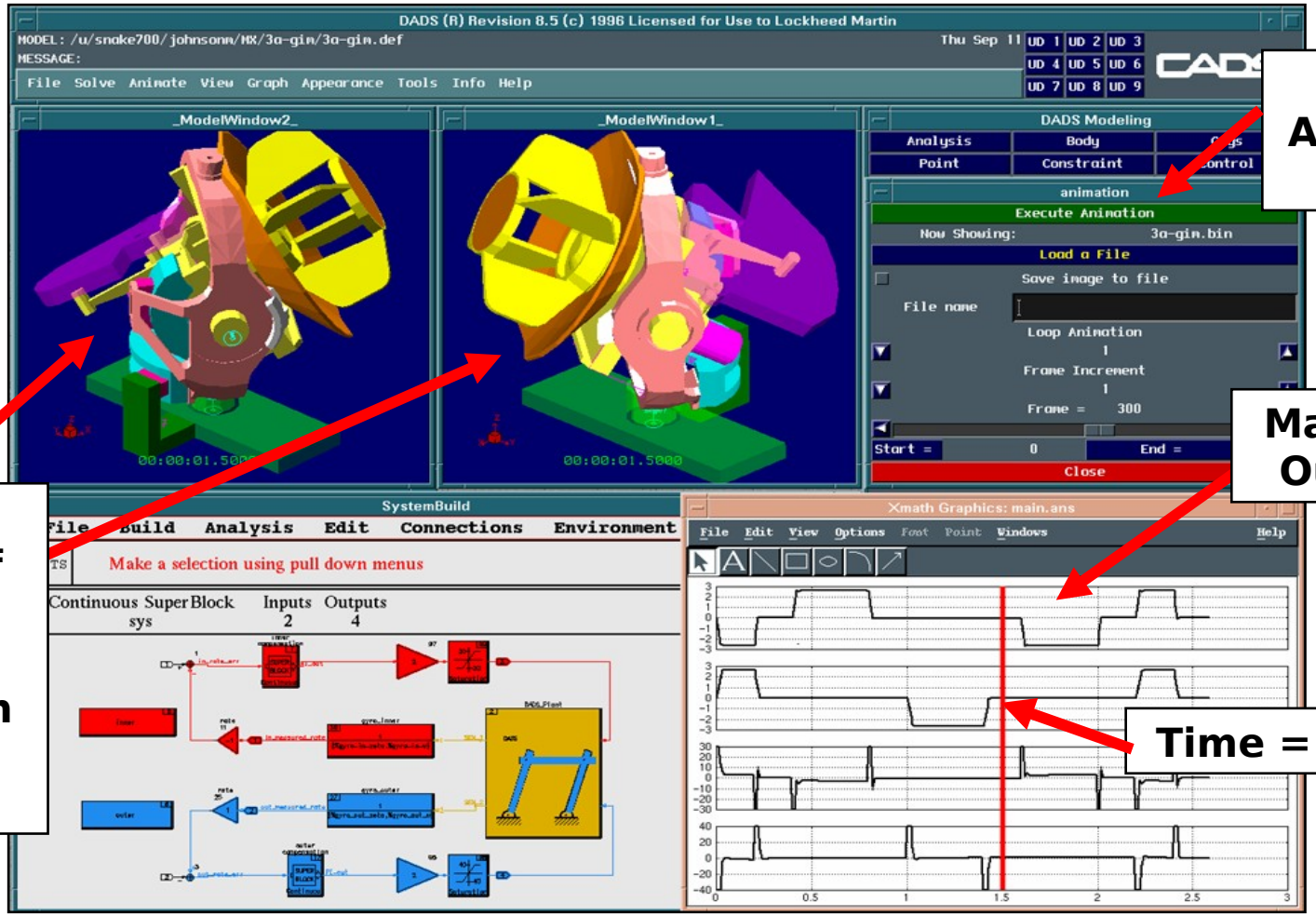




40:1 payback equals $6 million @ $100 per hour between design and maintenance

Systems Analysis

DADS animation output from Matrix-X to DADS Simulation



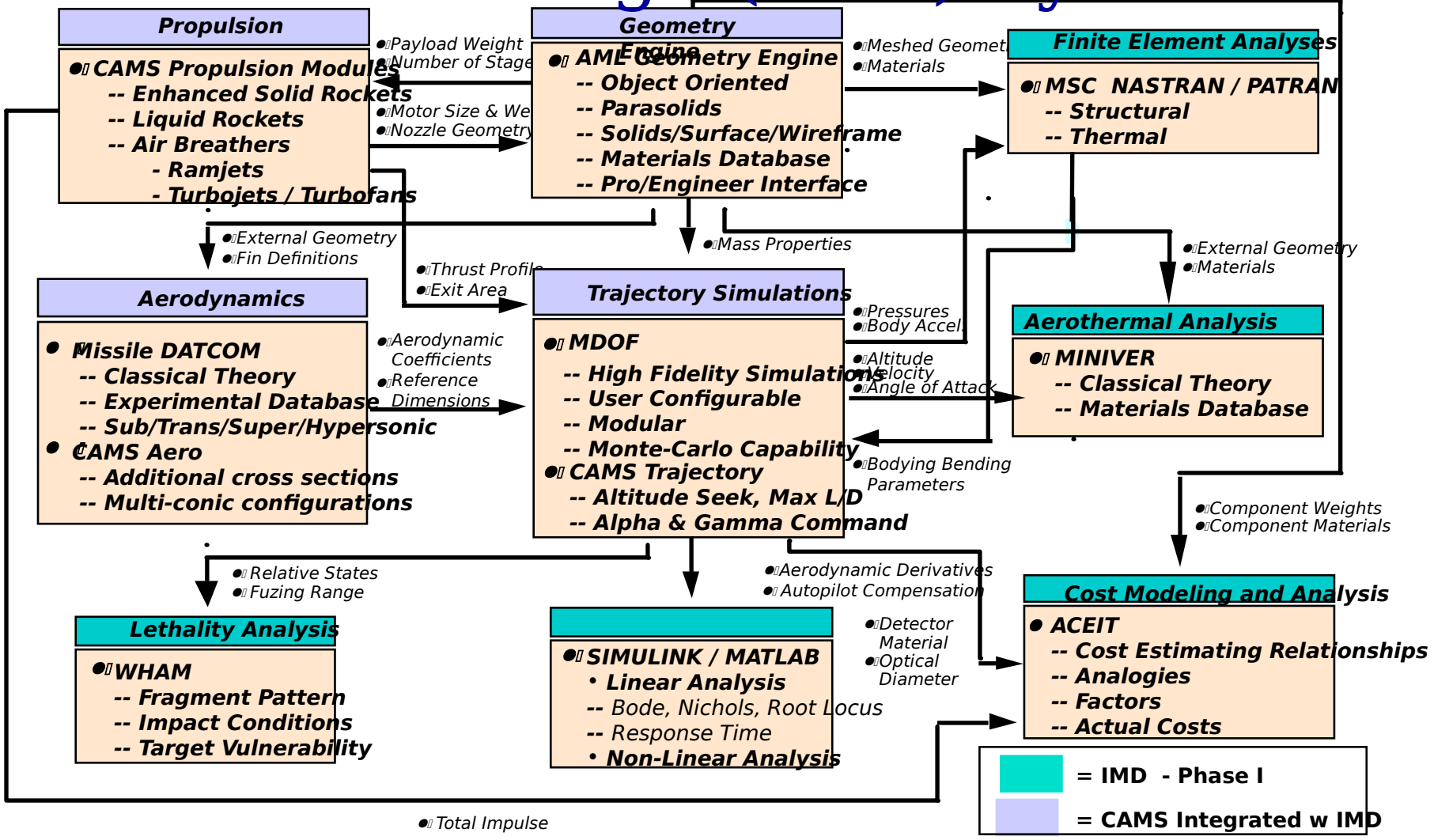
DADS Animation

Multi-view of DADS Output Position at 1.5 sec

Matrix-X Output

Time = 1.5 sec

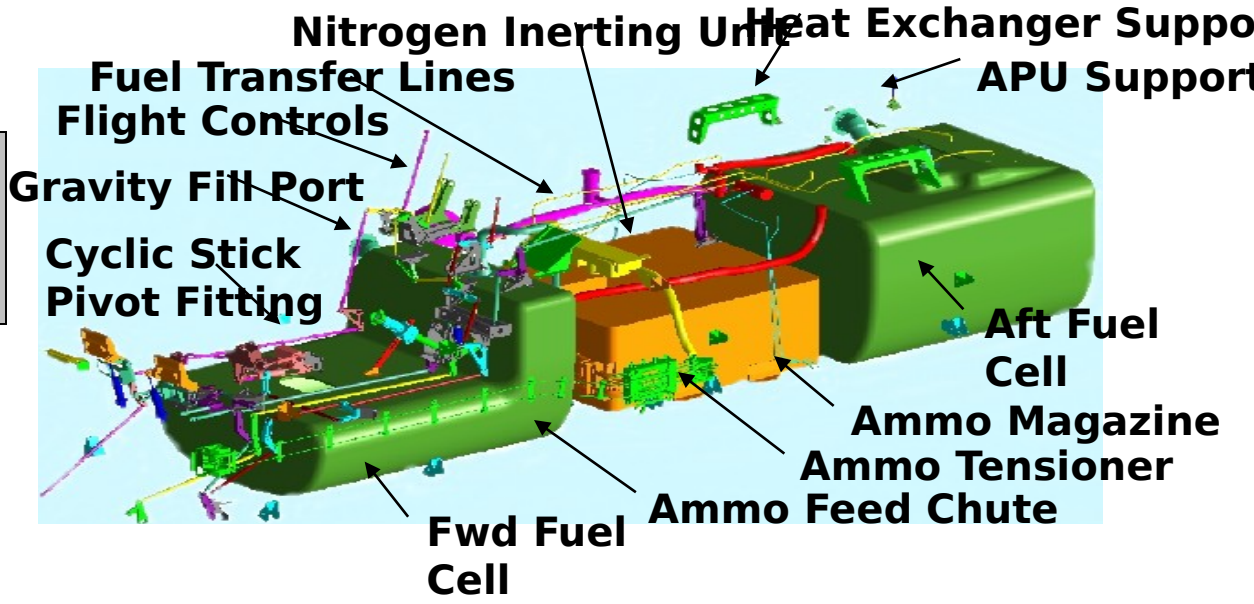
Overview: Interactive Missile Design (IMD) System



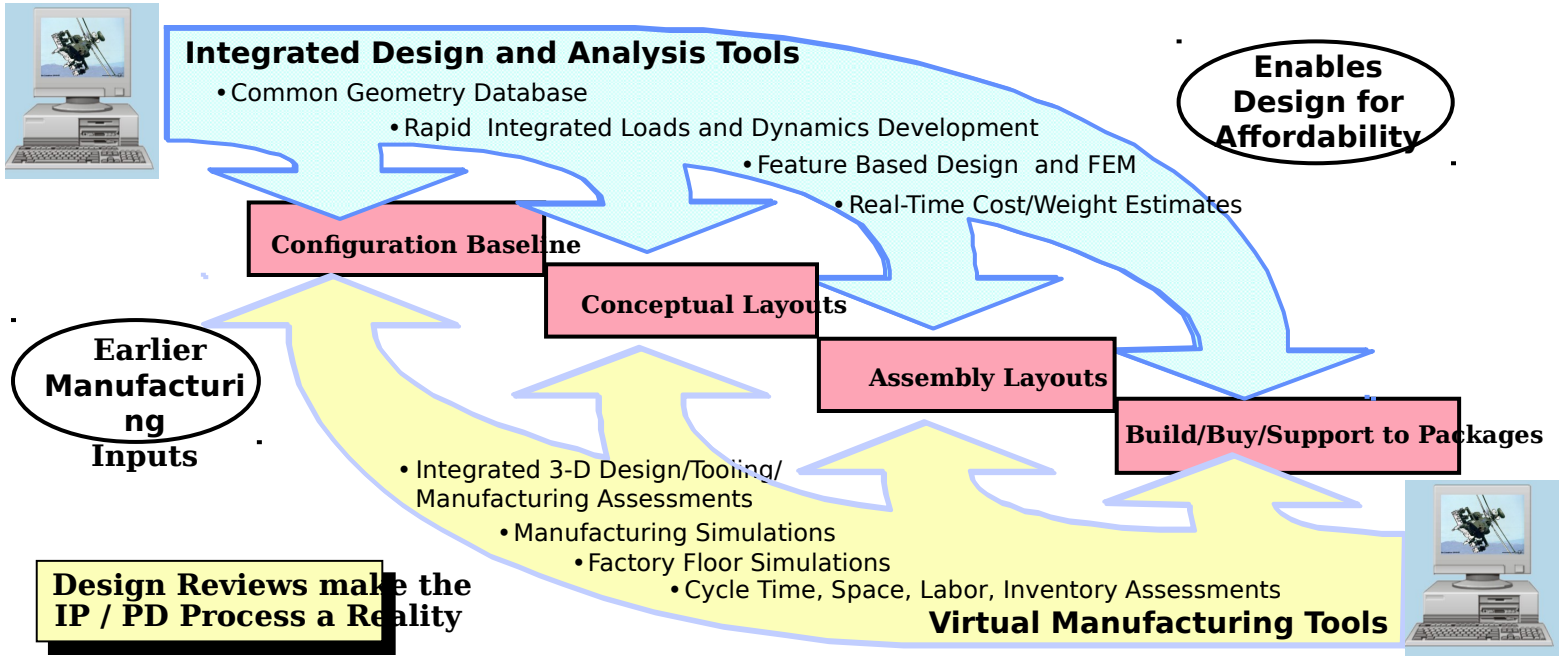
Boeing (McDonnell Douglas Helicopter Systems)

- **Rotary Wing Structures Technology Demonstration Program (RWSTDP)**
- **DMAPS – A Suite of VPD Tools for Integrated Product and Process Development (Design, Manufacturing and Producibility Simulation)**

SUBSYSTEMS IN CENTER FUSELAGE



Flow Chart Of DMAPS Process


Integrated Design and Analysis Tools
• Common Geometry Database
• Rapid Integrated Loads and Dynamics Development
• Feature Based Design and FEM
• Real-Time Cost/Weight Estimates
Enables Design for Affordability
Configuration Baseline
Conceptual Layouts
Assembly Layouts
Build/Buy/Support to Packages
Earlier Manufacturing Inputs
• Integrated 3-D Design/Tooling/ Manufacturing Assessments
• Manufacturing Simulations
• Factory Floor Simulations
• Cycle Time, Space, Labor, Inventory Assessments
Virtual Manufacturing Tools
Design Reviews make the IP / PD Process a Reality

Baseline	CLO	ALO	BTP

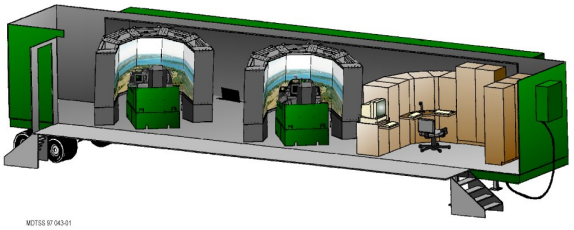
3-D Prototype

Objectives

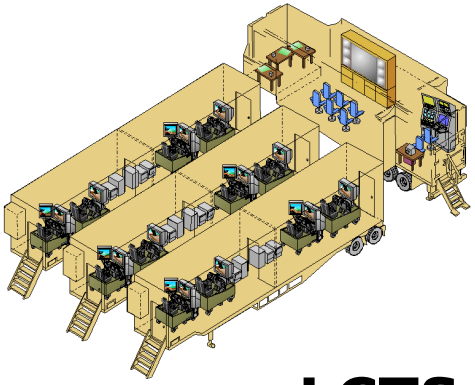
33 % Reduction in Design Cycle Time
25% Reduction in Design Personnel
33% Reduction in Manufacturing Cycle Time & Personnel
50% Reduction in Tooling Design and Fabrication Cost

Shortens the Design & Build Cycle Times and Improves First Time Quality

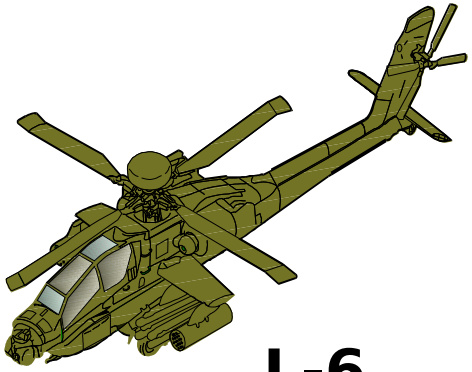
Apache Training Devices



LCT & LCT (M)



LCTS



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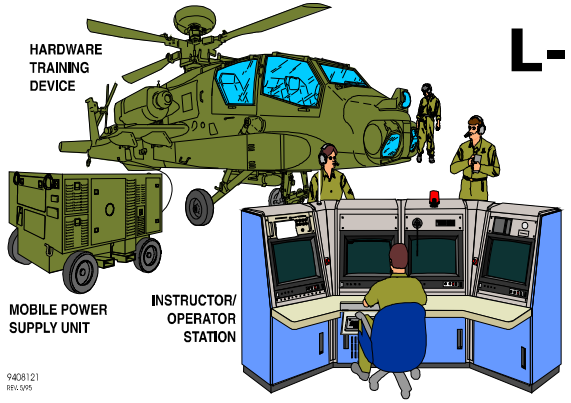

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Applications of SMART/SBA

- Candidates are in the P3I, OCIPL, Top 10 Cost Driver, and UFR Lists
- Apache Program is 93-94% Committed to Multi-year Production Contracts
- High Priority Candidates

1) 2nd GEN FLIR 2) Embedded Battle Command & 3) Rotor Blade 2000 Integrated Data Modem (IDM) 4) Longbow FCR on 5) SIRFC or ARC 220 (HF Radio) Comanche & Future Scout

"Industry will do what the customer wants. Outcome is determined by the rules and not by emotion. We will respond; but, there has to be an incentive." Steven Conver, Lockheed Martin

SMART/SBA in a Production Program

- Option 1: Apply SMART/SBA as an initiative across the entire Apache program
  - A direct overhead cost with imprecise metrics
- Option 2: Apply SMART/SBA against certain high value or high cost aspects
  - A direct cost to selected improvements using prototypes and established metrics
- Option 3: Apply SMART/SBA as a provision in any future contracts
  - An indirect cost to high payoff candidates subject to contract negotiations and funding.

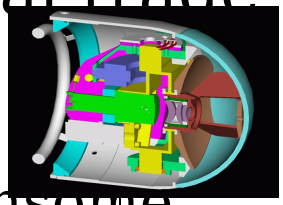
Does the program fund internally (production for M&S), externally, or collaboratively?

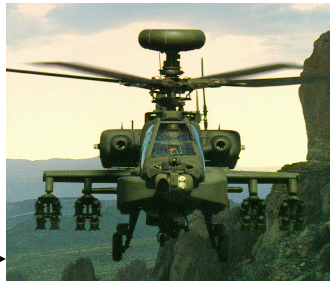
Observations

- Profitable Corporations use M&S profitably
  - But, M&S is a Corporate Asset and Guarded Carefully
- Industry will Mirror the Customer's Priorities and Organization
  - M&S is an overhead cost and industry would like to see more integration
- Expensive, High Risk (complex), High Visibility Programs Demand Proportionate M&S
- Industry concerns: 1) Staying Power of SMART/SBA; 2) Existing Programs Poorly Compare to "Virtual Systems"

Conclusions

- M&S exists at every level in the program, both in the system and “environment”
- Industry has made a tremendous investment, and keeps investing for strategic advantage
- M&S is not well integrated, especially between design and operational trade-offs
  - Not a single company bill
  - Could be expensive to fix
  - Could be administratively burdensome
- 50% reduction in cycle time and 30% reduction in cost of ownership will come from integration
- How to pay for it?





Recommendations

- Productize SMART in ACAT I and II Programs
- SMART/SBA as a Decision Component in P3I Prioritization
- Prototype 1-4 high payoff candidates, ***then*** Incorporate SMART/SBA as a Contract Provision in the Proposed Effort
- Cost share the application of SMART/SBA between Government and Industry

Areas for Further Exploration

- Logistics System Modeling
- Integration of Program M&S with Information Systems Modeling (C4ISR, JTA-A, Army Enterprise Strategy)
- SMART as a Complement to Spiral Development
- SMART used to Reduce Test and Evaluation (virtual testing)
- Integration of SMART into Army & DoD Cost Models (POM Builds)
- SMART use of Process and Data Models
- HTI Validation through the use of SMART

"If you can't do it with brainpower, you can't do it with manpower - overtime." Kelly Johnson, F-16 & SR71 System Architect